(12) UK Patent Application (19) GB (11) 2 127 129 A

(21) Application No 8325051
(22) Date of filing 19 Sep 1983
(30) Priority data
(31) 8226656
(32) 18 Sep 1982
(33) United Kingdom (GB)
(43) Application published
4 Apr 1984
(51) INT CL³
F16G 15/04
(52) Domestic classification
F2Q 53
U1S 1868 F2Q
(56) Documents cited
GB 1022085
GB 0943068
GB 0632584
(58) Field of search
F2Q
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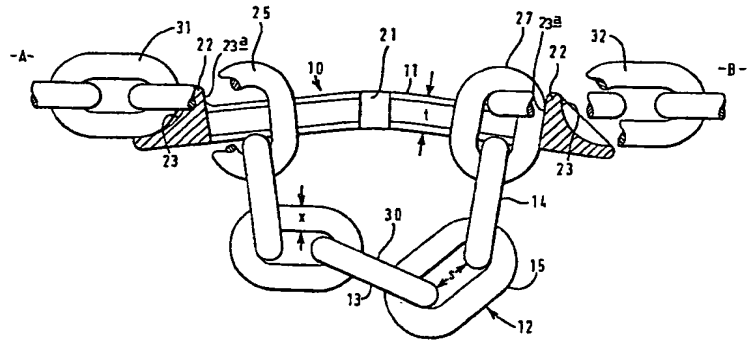
(54) **Chain shortening/connecting**

(57) A chain (12) can be shortened, or two chains can be connected, by a method which utilises a chain/connecting device (10). An aperture (16) in a body (11) of the device comprises a first portion (21) and a second portion (26,28). The chain can be threaded through the aperture 16 at the intersection (21) and first and second links of the chain can be entrapped in the second parts 26. 28.

FIG 1



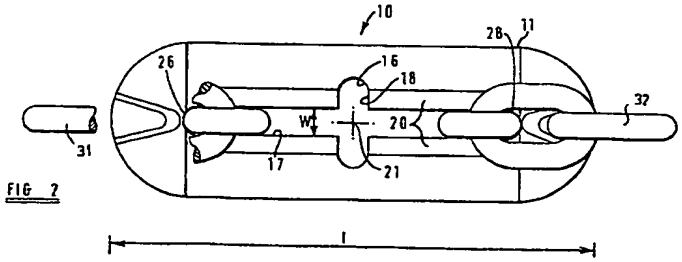


FIG 2

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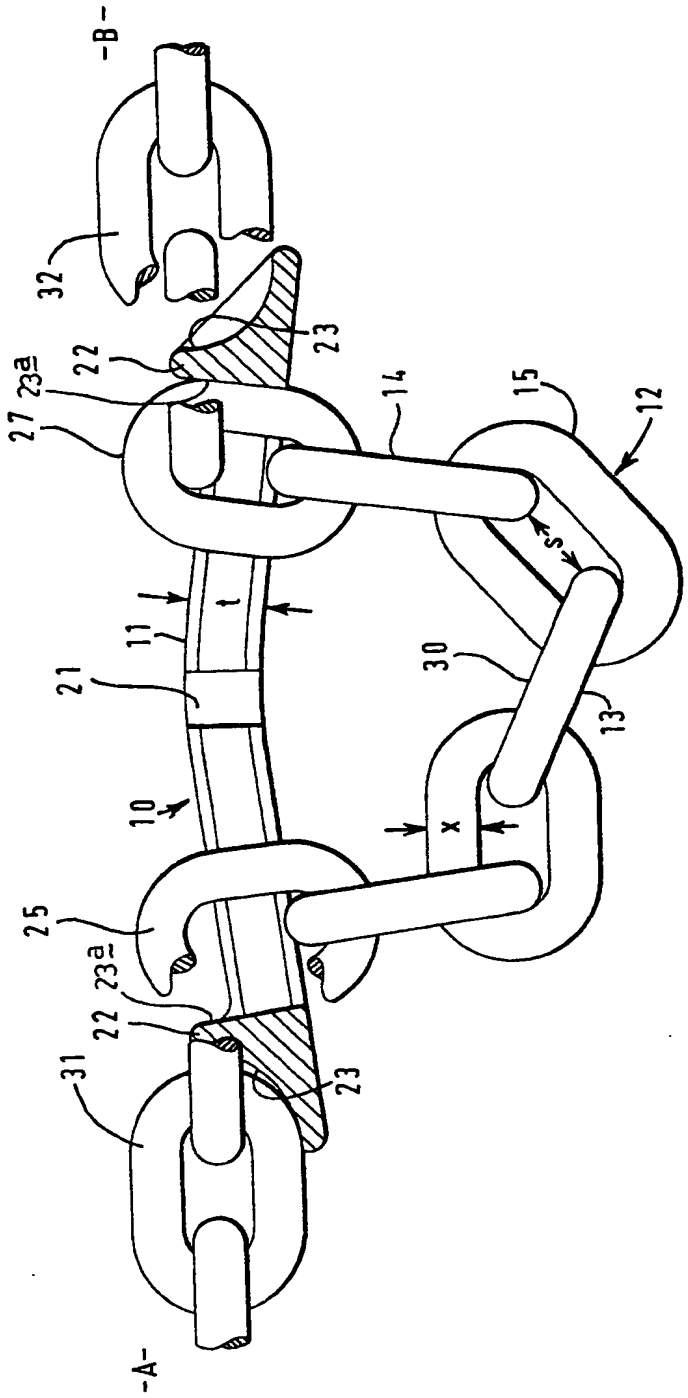

FIG 1

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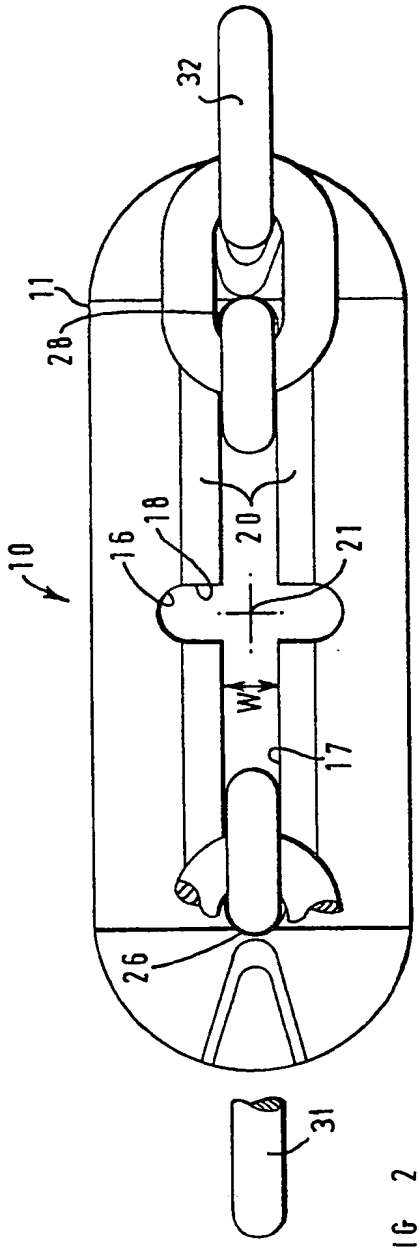

FIG 2

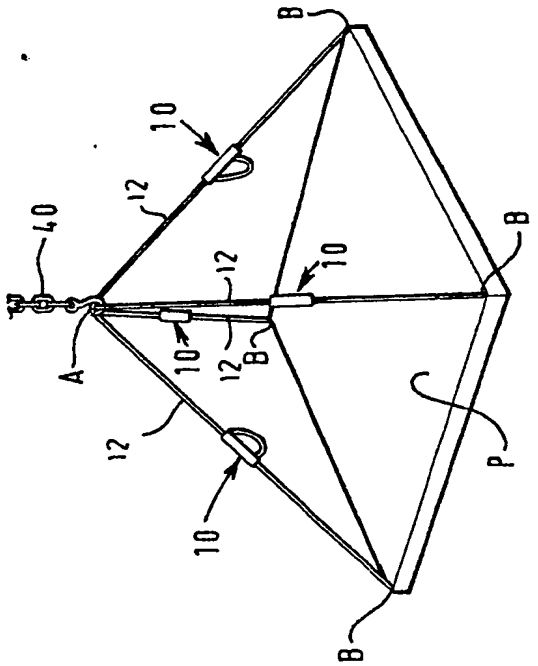

FIG 4.

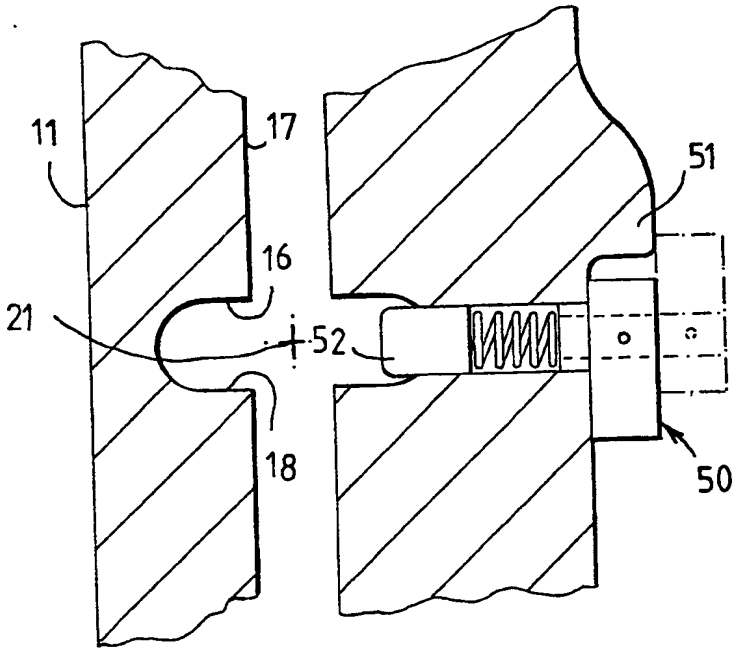

FIG 3.

SPECIFICATION

Chain shortening/connecting

This invention relates to a method of shortening a chain or connecting two lengths of chain together, using a chain shortening/connecting device.

Previously, where it has been required to shorten a chain, it has been necessary to utilise a chain clutch at one end of the chain, such chain clutch comprising a length of chain of at least the same strength as the chain to be shortened, which is attached to a master link to which the end of the chain to be shortened is also connected, the length of chain of the clutch carrying at its end a cup into which a link of the chain to be shortened can be retained. The link is retained in the cup by a load which acts through the shortened chain, the cup and the length of chain of the clutch. A loop of the shortened chain may extend beside the length of chain of the clutch but does not support the load. Such chain clutches have many disadvantages.

First, the clutch can only be provided adjacent the top end of the chain to be shortened, otherwise it would be necessary for the length of chain of the clutch to extend to the required position along the chain, thus greatly increasing the required quantity of chain, which provision is an unwarranted expense.

Secondly, such clutches can only successfully be used in one orientation, i.e. with a downward load, because of the necessity to retain the link in the cup.

Thirdly, such clutches are expensive to produce requiring a cup, a length of chain and connecting links which enable the length of the chain to be secured to the master link. The cup generally needs to be cast and hardened and tempered and the three components need to be assembled. Such clutches have been made for many years with all these disadvantages.

It is an object of the present invention to provide a new improved method of shortening a chain.

According to a first aspect of the invention, we provide a method of shortening a chain using a chain shortening device comprising a body having one aperture or a pair of apertures therein, the or each aperture comprising a first portion of such dimension to permit a chain to be threaded therethrough and one or more second portions being, or each being, of such dimension to entrap a link of the chain therein and prevent an adjacent link passing through or back through the aperture, the method comprising the steps of passing one end of the chain from one side of the body through the or one of the apertures at the first portion until the device is at a required position intermediate the ends of the chain with a first link in the aperture, moving the first link of the chain in the aperture in a first direction to a or the second portion of the aperture and retaining the first link away from said first portion, thus locking the first link in the aperture and preventing an adjacent link passing through or back through the aperture, passing said one end of the chain from the other side of the body, or passing the other end of the chain from the one side of the body through the first portion of the aperture or through the first portion of the or the other, aperture until a predetermined length of the chain is at the other side or the one side respectively of the body in a loop and a second link is in the, or the other, aperture, moving the second link of the chain in the, or the other, aperture in a second direction generally opposite to said first direction to another, or the, second portion of that aperture and retaining the second link away from said first portion, thus locking the second link in the aperture and preventing an adjacent link passing through or back through that aperture.

Thus this method overcomes all of the disadvantages of using a conventional chain clutch because:

(a) the chain shortening device can be provided at any required position along the length of the chain;

(b) the chain is not restricted to any particular orientation;

(c) the chain shortening device is a one-piece construction thereby reducing the cost of production.

It will be appreciated that the loop at said other side of the body plays no part in supporting the load but the chain shortening device acts as a bridging link across the loop. Thus the loop may be broken without releasing the load.

Accordingly, the chain shortening device is also capable of use as a chain connecting device, for connecting two lengths of chain together.

It is a further object of the invention to provide a new or improved method of connecting two lengths of chain.

According to a second aspect of the invention, we provide a method of connecting two lengths of chain together using a chain connecting device comprising a body having one or a pair of apertures therein, the or each aperture comprising a first portion of such dimension to permit a chain to be threaded therethrough and one or more second portions being, or each being, of such dimension to entrap a link of the chain therein and prevent an adjacent link passing through or back through the aperture, the method comprising the steps of passing one end of the chain from one side of the body through the or one of the apertures at the first portion, moving a first link of said one chain in the aperture in a first direction to a second portion and retaining the first link away from said first portion, thus locking the first link in the aperture and preventing an adjacent link passing through or back through the aperture, passing an end of the other of the chains from said one or other side of the body through the first portion of the aperture or through the first portion of the other aperture, moving a second link of said other chain in the or the other aperture in a second direction generally opposite to said first direction to another, or the, second portion of that aperture and retaining the second link away from said first portion thus locking the second link in the aperture and preventing an adjacent link passing through or back through that aperture.

Thus a simple and quick method of connecting two lengths of chain together is provided.

When the first and second links have been moved

in their first and second directions respectively, the first and second links may be retained away from the first portion or portions by putting the chain under load and/or by providing some retaining means so that if the chain or chains slacken, there is no risk of either the first or second links moving to the first portion or portions of the or other respective apertures. To facilitate this, the adjacent links to the first and second links may extend from the first and second links at an angle.

Conventional chain clutches have another disadvantage in that the connection between the chain and the cup tends to reduce the tensile strength of the chain at that position, and thus it is not advisable to load the chain, and clutch, to the full rated load an unshortened chain could withstand. In the trade, this is known as de-rating the chain.

In the present invention, projecting formations, such as ears integral with the body, may be provided which engage each entrapped link, and the respective next adjacent link, to ensure that de-rating of the chain does not occur.

The projecting formations may extend into their respective adjacent links and have a first abutment formation to engage an inner surface of a next adjacent link, and a second abutment formation to engage the entrapped link.

The body of the device may be curved or stepped between the entrapped links so that the load is transmitted along a straight line through the body.

Preferably, the aperture or apertures comprise slots having first and second parts which intersect, the first aperture portion being located at the intersection of the slot parts and the second aperture portion comprising a region of one or other of the slot parts, spaced from the intersection. The body may be elongate and at least one of the slot parts of the or each aperture may extend along the length of the body. Thus as a load is imposed on the chain, the first and second links are pulled to the ends of their respective slot parts in which they are received, which comprise said second aperture portions, in opposite directions, so that the body of the device extends in a direction generally longitudinally of the chain.

Where projecting formations are provided, these may be provided at the end of the slot part or parts in which the first and second links are entrapped.

Preferably, the body is thinner, at least in the region of the apertures, than the maximum dimension of the first and second links.

According to a third aspect of the invention, we provide a chain shortening/connecting device for shortening a chain or connecting two lengths of chain together by a method according to the first or second aspects of the invention respectively, said device comprising a body having at least one aperture therethrough, the or each aperture comprising first and second slot parts which intersect intermediate their ends and extend generally transversely to one another, the body and the slot parts being of such dimension to permit a chain to be threaded through a first aperture portion located at the intersection of the slot parts, and entrapped in a second aperture portion comprising a region of one or other of the slot parts spaced from the intersection.

In one example, alternate links may pass through the first slot part only and the remaining links pass through the second slot part only, at the intersection.

The invention is particularly applicable to a lifting device such as a chain sling of the type having a hoist means from which a plurality of chains extend, the other ends of the chains being connected to a pallet or other lifting platform on which an article is to be lifted, or directly to an article. In order to keep the article level during lifting, for example where the article is provided on a lifting platform, it is desirable for at least one, if not all of the chains, to be provided with a chain shortening device. Previously, chain shortening clutches have been used with all their inherent disadvantages.

It is a further object of the invention to provide a new or improved lifting device of the kind described.

According to a fourth aspect of the invention, we provide a lifting device comprising a hoisting means, at least two chains which extend from the hoisting means to spaced positions of a load to be lifted, at least one of the chains having a chain shortening device according to the third aspect of the invention.

The "load" may comprise an article to be lifted, or a pallet or other platform on which the article is to be lifted is supported.

The invention will now be described with the aid of the accompanying drawings, in which:-

Figure 1 is a diagrammatic side view of a chain shortening/connecting device for use in the methods of the first and second aspects of the invention, partly in section;

Figure 2 is a plan view of the chain shortening/connecting device shown in Figure 1;

Figure 3 is a cross-sectional view in plan of a central portion of another embodiment of chain shortening/connecting device.

Figure 4 is a diagrammatic illustration of a lifting device incorporating chain shortening/connecting devices of Figures 1 and 2;

Referring to Figures 1 and 2 of the drawings, a chain shortening/connecting device 10 comprises a body 11 of steel plate, hardened as required and able to support the same load in a manner hereinafter to be described, as a steel or other metal or alloy oval link chain 12, of well known construction. The device 10 could be made of any other material having at least the same strength as steel.

The body 11 has a thickness *t* less than the free space *s* between each alternate pair of links of the chain 12 e.g. links 13 and 14, and an overall length *l* approximately equal to four links of the oval chain 12.

The body 11 has an aperture 16 therethrough comprising a first slot part 17 which extends longitudinally of the body 11 of width W only a small amount wider than the thickness *x* of the links of the chain 12, and a second slot part 18 transverse to first slot part 17, and again of width only a small amount wider than the thickness of the links.

The edges 20 of the first slot part 17 are chamfered on both sides. The first and second slot parts 17, 18 intersect at a first portion 21 of the aperture and the

body 11 at each side of the intersection is downwardly curved for a reason hereinafter explained.

First slot part 17 extends along the body 11 of the device 10 from the intersection 21 to second aperture portions through which the chain cannot be threaded. In the present example, the second portions comprise the end regions of the slot part 17. Further, at each end of the first slot part 17 there is a projecting formation comprising an upstanding ear 22 which may be integral with the remainder of the body 11 as shown, or attached thereto as required. The ears 22 have a first abutment formation comprising a curved side 23, curved at a similar curvature to the ends of the links of the chain 12, which side 23 is engaged by links 31, 32 which are, respectively, the next but one links to links 25, 27 which are entrapped in the apertures as hereinafter explained, and a second abutment formation comprising a plane face 23*a* which engages the entrapped links 25, 27. Thus de-rating of the chain 12 does not occur.

Operation of the device 10 will now be described.

To shorten a chain 12, one end of the chain to be shortened, i.e. an end in the direction of A, (although the end cannot be seen in the drawing), is threaded upwardly through the aperture 16 at the intersection 21 of the first and second slot parts 17, 18 with alternate links of the chain 12 passing through the first slot part 17, whilst the remaining links pass through the second slot part 18. The links in the same plane as link 15 would pass through the first slot part 17, whilst the links in the same plane as the links 13 and 14 would pass through the second slot part 18. The intersection of parts 17 and 18 thus provide a first portion of the aperture of such dimension to enable the chains to be threaded therethrough.

When the device 10 is at any selected position along the chain 12, a first link, i.e. the link indicated at 25, in the same plane as link 15, is located in the slot part 17, and is moved along the slot part 17 in a direction longitudinally of the body 11 to an end region 26 of the slot part 17 which provides a second portion of the aperture.

Because at the end 26, the first slot part is only a small amount wider than the thickness of the links of the chain 12, the adjacent links to link 25 which are in the same plane as the links 13, 14, are prevented from passing through, or back through the aperture 16, the ends of the adjacent links abutting or lying closely adjacent to the chamfered edge 20 of the slot part 17. The link 25 is thus entrapped at the end 26 of slot part 17.

The other end of the chain indicated in the direction B, although again the end of the chain 12 cannot be seen in the drawing, is also threaded upwardly through the aperture 16 at the intersection 21, again with the links in the same plane as link 15 passing through the first slot part 17 at the intersection 21, and the remaining links in a plane similar to links 13, 14 passing through the second slot part 18.

When the desired amount of chain has been fed through the aperture 16, with a link 27 in the same plane as link 15 located in the first slot part 17, the link 27 is moved to an end region 28 of slot part 17, opposite to end 26.

Thus the link adjacent to link 27 in the same plane as links 13, 14 would be prevented from passing through or back through the aperture 16.

It can be seen that a loop 30 of chain 12 will then be present beneath the body 10 as shown in the drawings, which loop 30 may be of any desired size and have any number of links, to shorten the chain 12 by a desired amount.

When the chain 12 is put under load, the links adjacent to links 25, 27 above the body 10, will pivot to the position shown and lie generally perpendicular to links 25 and 27, and the ears 22 on the end of the body 11 will be received within the interior of these adjacent links.

Thus the load imposed on the chain 12 will act through the body 11 which behaves as a bridge between links 25 and 27. The load will not bear on the ends 26, 20 of the first slot part 17 but rather on the ears 22. It has been found that provision of such ears 22 considerably reduces the wear of the chain 12 and the body 11.

The next adjacent links to links 25, 27, which are indicated at 31, 32 are positively located by the curved surfaces 23 at the ends of the body receiving the outer curved surface of the oval links.

Because the body 10 is curved at either side of the intersection 21 between the respective parts of the aperture where the first and second links engage the body, it can be seen that the load is transmitted from link 31 to link 32 via the adjacent links and links 25, 27 and the device 10, along a straight path. If the body 10 is not curved, when a large load is imposed on the body, the body would in any case tend to deform to the configuration shown. Preferably however, the body is made in this configuration and hardened.

Of course, the device 10 can be located at any desired position along the length of the chain 12. If it is desired to further shorten or lengthen the chain 12, one of the links 25 or 27 would need to be moved along the slot part 17 to the intersection 21, to permit the chain 12 to be passed through the aperture 16.

In use, when the chain 12 is under load, links 25, 27 are prevented from moving to the intersection 21 by the load. Thus the device 10 can be used in any orientation and is not limited to that shown.

Furthermore, if the chain 12 slackens, for example as the load is released, to prevent the links 25, 27 moving towards the intersection 21, rotating means may be provided in the slot part 17, such as a stopper or lock.

Additionally or alternatively a restraining means 50 may be provided in the slot part 18, to prevent the chain being threaded through the intersection 21 between the slot parts 17, 18, when the chain slackens. The one example of restraining means illustrated in Figure 3 comprises a bolt 52 which is movable between a first position in which the bolt projects into the aperture 16 and a second position in which the bolt is clear of the aperture 16. The bolt 52 may be spring-loaded as shown to project into the aperture 16, with anchoring means in the form of a projection 51 on the body 11 for anchoring the bolt 52 in the clear position.

A chain shortening device 10 in accordance with

the invention is particularly useful for use in lifting devices such as chain slings of the type shown in Figure 4 comprising a hoisting means 40, such as a hook provided on a chain which is lifted by a mechanical winch, to which two or more chains 12, in the example shown four chains, are secured at their one ends A, which chains 12 are secured at their other ends B at spaced positions to a load, which preferably comprises a pallet P on which, in use, an article is lifted. Alternatively the chains 12 could be secured direct to the article.

To ensure that the load remains level during lifting, the lengths of one or more of the chains 12 are adjustable using a chain shortening device 10 as hereinbefore described. As shown, each of the four chains has a shortening device 10. Thus any stretching of the chains 12, can be accommodated.

Referring again to Figure 1, it will be appreciated that, when in use, the links of the loop 30 of the chain 12 play no part in supporting the load. Link 13 for example can thus be broken without any detrimental effect to the supported load.

Thus the device 10 could also be used to connect together two lengths of chain, in which case an end of each chain would be threaded through the aperture downwardly as shown in the drawings, and in turn a link, such as link 25, 27, moved to an end 26, 28 of the first slot part 17.

Again, if desired, means may be provided to prevent the links moving towards the intersection if the chain slackens. In all other respects, the method and device are identical to that of the device and method described above.

As described, the device is elongate and first and second slot parts mutually perpendicularly intersect, if desired the body 11 could be of any other shape, and the slot parts 17, 18 need not intersect mutually perpendicularly. The slot parts 17, 18 need not be of the lengths shown, for example where the body is another shape, the second slot part 18 could be longer than the first slot part 17. The aperture 16 need not comprise two slot parts but may be of any desired configuration providing a first portion which permits the chain to be threaded through, and at least one second portion in which the chain can be entrapped.

Although in each of the examples described above, the chains 12 have been described as comprising oval link chains, by suitable modification of the device 10, other chains could be accommodated. Furthermore, where different chain sizes are used, the widths W of the first and second slot parts 17, 18 would need to be different and thus different chain shortening device may need to be provided for each chain size, to ensure that the width of the slot is only a small amount greater than the thickness x of the links but not so much wider that adjacent links to the link received in the aperture, are not prevented from passing through or back through the aperture 16.

If desired, instead of providing a single aperture, two apertures may be provided. Where the device is used for shortening a chain, the loop would extend between the apertures. Where the device is used for connecting two lengths of chain together, a link of each chain length would be received in one of the apertures.

The device 10 may be made as a forging, or cast, or fabricated, although some hardening and/or tempering may be required in order to give the device the same, or greater tensile strength as the chain or chains 12 with which it is used.

CLAIMS

1. A method of shortening a chain using a chain shortening device comprising a body having one aperture or a pair of apertures therein, the or each aperture comprising a first portion of such dimension to permit a chain to be threaded therethrough and one or more second portions being, or each being, of such dimension to entrap a link of the chain therein and prevent an adjacent link passing through or back through the aperture, the method comprising the steps of passing one end of the chain from one side of the body through the or one of the apertures at the first portion until the device is at a required position intermediate the ends of the chain with a first link in the aperture, moving the first link of the chain in the aperture in a first direction to a or the second portion of the aperture and retaining the first link away from said first portion, thus locking the first link in the aperture and preventing an adjacent link passing through or back through the aperture, passing said one end of the chain from the other side of the body, or passing the other end of the chain from the one side of the body through the first portion of the aperture or through the first portion of the other aperture until a predetermined link of the chain is at the other side or the one side respectively of the body in a loop and a second link is the, or the other, aperture, moving the second link of the chain in the, or the other, aperture in a second direction generally opposite to said first direction to another, or the, second portion of that aperture and retaining the second link away from said first portion, thus locking the second link in the aperture and preventing an adjacent link passing through or back through that aperture.

2. A method of connecting two lengths of chain together using a chain connecting device comprising a body having one or a pair of apertures therein, the or each aperture comprising a first portion of such dimension to permit a chain to be threaded therethrough and one or more second portions being, or each being, of such dimension to entrap a link of the chain therein and prevent an adjacent link passing through or back through the aperture, the method comprising the steps of passing one end of the chain from one side of the body through the or one of the apertures at the first portion, moving a first link of said one chain in the aperture in a first direction to a second portion and retaining the first link away from said first portion, thus locking the first link in the aperture and preventing an adjacent link passing through or back through the aperture, passing an end of the other of the chains from said one or other side of the body through the first portion of the aperture or through the first portion of the other aperture, moving a second link of said other chain in the or the other aperture in a second direction

generally opposite to said first direction to another, or the, second portion of that aperture and retaining the second link away from said first portion thus locking the second link in the aperture and preventing an adjacent link passing through or back through that aperture.

3. A method in accordance with Claim 1 or Claim 2 wherein, when the first and second links have been moved in their first and second directions respectively, the first and second links are retained away from the first portion or portions by putting the chain under load.

4. A method in accordance with Claim 1 or Claim 2 wherein, when the first and second links have been moved in their first and second directions respectively, the first and second links are retained away from the first portion or portions by a retaining means.

5. A method in accordance with Claim 1 or Claim 2 wherein, when the first and second links have been moved in their first and second directions respectively, the chain is restrained against threading through the first portion by a restraining means.

6. A method in accordance with any preceding claim wherein the body comprises projecting formations which engage each entrapped link and the respective next adjacent link.

7. A method in accordance with Claim 6 wherein the projecting formations extend into their respective adjacent links and have a first abutment formation to engage an inner surface of a next adjacent link, and a second abutment formation to engage the entrapped link.

8. A method in accordance with any preceding claim wherein the body of the device is curved or stepped between the first and second links.

9. A method in accordance with any preceding claim wherein the aperture or apertures comprise slots having first and second parts which intersection, the first aperture portion being located at the intersection of the slot parts, and the second aperture portion comprising a region of one or other of the slot parts spaced from the intersection.

10. A method in accordance with Claim 9 wherein the body is elongate and at least one of the slot parts of the or each aperture extends along the length of the body.

11. A method in accordance with Claim 8 or 9 as appendent to any one of Claims 5, 6 or 7 wherein the projecting formations are provided at the ends of the slot part or parts in which the first and second links are entrapped.

12. A method in accordance with any preceding claim wherein the body is thinner, at least in the region of the apertures, than the maximum dimension of the first and second links.

13. A chain shortening/connecting device for shortening a chain or connecting two lengths of chain together by a method according to any one of the preceding claims, said device comprising a body having at least one aperture therethrough, the or each aperture comprising first and second slot parts which intersect intermediate their ends and extend generally transversely to one another, the body and the slot parts being of such dimension to permit a chain to be threaded through a first aperture portion located at the intersection of the slot parts and entrapped in a second aperture portion comprising a region of one or other of the slot portions spaced from the intersection.

14. A lifting device comprising a hoisting means, at least two chains which extend from the hoisting means to spaced positions of a load to be lifted, at least one of the chains having a chain shortening device according to Claim 13.

15. A method substantially as herein described with reference to the accompanying drawings.

16. A chain shortening/connecting device substantially as herein described with reference to and as shown in the accompanying drawings.

17. A lifting device substantially as herein described with reference and as shown in the accompanying drawings.

18. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1984.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.